

Organizing a Pediatric Neurocritical Care Service

Steven Weinstein, MD

Director, Pediatric Comprehensive Epilepsy Program

Professor of Clinical Pediatrics

Weill Cornell Medical College

NewYork-Presbyterian Hospital



Weill Cornell Medical College



NewYork-Presbyterian
Phyllis and David Komansky
Center for Children's Health

What does it take?

PICU with acute neurologic volume

PICU staff: primary interest nervous system

Neurology: value added (think ICU)

EEG review 24/7

Funding source

Neurosurgery: willingness to share

Nursing staff: dedicated

Toys: available

Clinical follow up/ data collection

Supportive administration

Table 1 Leapfrog requirements for neurointensive care units

Staffing standards	Neurointensive care units must meet the staffing standards that have been previously set for adult or pediatric general medical and/or surgical intensive care units.
Management leadership	Patients in a neurointensive care unit must be managed or comanaged by 'neurointensivists' or critical care intensivists who are ordinarily present in the intensive care unit during daytime hours a minimum of 8 h per day, 7 days per week, and during this time provide clinical care exclusively in the unit.
Staff availability	When not present in the unit, 'neurointensivists' or critical care intensivists must return more than 95% of intensive care unit pages within 5 min.
Neurointensivists	Specialists classified as neurologists and neurological surgeons who are board certified in their primary specialty and who have completed a United Council for Neurologic Subspecialties certified fellowship training program in neurocritical care, or a physician who is board certified in neurocritical care.

Models of PNICU

A [neuroscience (NS) service]

Alpha [coordinating NS service with CCM]

Aleph (integrated interdisciplinary service)

Virtual Pediatric Neurocritical Care Unit

Administration support

COO Peter Holbrook, MD (grandfather of PICU)

PICU Chief, Murray Pollack, MD (PRISM score)

Neurology

Dedicated neurologist SW

Neurology fellows (pediatric and adult)

Neurosurgery

3 full time, joint rounds

PICU

2 teams

1: dedicated to neurosciences

Consultant

MB

Taubin neuroICU: 4 dedicated beds, over flow

CNMC experience

April 2001-May 2007

Neurology critical care consults 373 (26%)

Total PICU admissions 1423

EEG 152

vEEG 70

Unit introduced prior to routine EEG availability

Salary support

Consults

EEG

Outpatient responsibilities minimized

Family centered Team Rounds

Table 2 Reasons given for Pediatric Neurocritical Care Medicine (PNCCM) consult

Reason	Number (%)
Seizure/possible seizure	132 (35.3)
Postoperative monitoring	79 (21.2)
ICP management	66 (17.7)
Change in mental status	41 (11.0)
New focal neurological deficit	32 (8.6)
Prognosis after CNS event	13 (3.5)
Pre-existing neurological condition	9 (2.4)
Other	1 (0.3)

Table 1 Admission diagnoses for children who had Pediatric Neurocritical Care Medicine (PNCCM) consult

Primary neurological	Number (%)	Primary medical	Number (%)
Status epilepticus	70 (18.9)		
TBI	53 (14.2)	Respiratory failure	41 (11.0)
Tumor	48 (12.8)	Cardiovascular, non-CNS	27 (7.2)
Neurosurgical procedure, other	24 (6.4)	Shock	22 (5.9)
Hydrocephalus	17 (4.6)	Cardiac arrest	14 (3.8)
SAH/ICH	13 (3.5)	Coma, unknown cause	14 (3.8)
Stroke	7 (1.9)	Ingestion	5 (1.3)
Meningitis	5 (1.3)	DKA	5 (1.3)
Other	2 (0.5)	Other	6 (1.6)
Total	239 (64.1)		134 (35.9)

Legend: TBI—traumatic brain injury; SAH/ICH—atraumatic subarachnoid hemorrhage or intraventricular hemorrhage; stroke—all arterial ischemic strokes and cerebral sinovenous thromboses; meningitis—inclusive of meningitis and meningoencephalitis disorders; DKA—abnormal neurological findings associated with diabetic ketoacidosis

Adult units: metabolic encephalopathy 29%, seizures 28%, HIE 24%, stroke 15%

☐ Bleck 1993, Crit Care Med

Post operative tumor 20%, stroke 15%, SAH 12%

Ropper 2003. Neurological and neurosurgical intensive care.

Table 3 Resources utilized by children for whom Pediatric Neurocritical Care Medicine (PNCCM) consult was obtained

Modality	Number of children (%)
EEG	152 (40.8)
cEEG	70 (18.8)
CT brain	284 (76.1)
MRI brain	171 (45.8)
TCD	13 (3.5)
Cerebral arteriogram	11 (2.9)
NIRS	46 (12.3)
Bedside ICP monitor	35 (9.4)
PbtO ₂	5 (1.3)

Information sources

Children's Hospital National Medical Center
Bell M, et al
Neurocrit Care 2009; 10(1):4-10

PICUlistserve (#31)
Greenwald B

NACHRI database 2007 (#147)
National Association of Children's Hospitals
and Related Institutions

Institutional Web Sites supplement

Can this model be replicated?

Difficulties with data

Numbers and severity of acute brain impairments not known

Unclear what is a PICU bed in response to listserve
CICU or step down units included?
?Neurosurgical beds separate

Physician numbers

Part time ?included as FTE

Are adult services covering?

CICU and PICU attendings ?integrated

Limited numbers of PICU responses

CHNMC

ICU beds incl CICU 283 beds PICU/CICU 27 beds
26 neurologists PICU 12 Neurosurg 4
Dedicated neurologist and neuro fellow

Survey (+web)

	Total	Median	Average
Hospital beds (#19):	81-510	244	
ICU beds incl CICU (#26):	4-69	21	25
Neurologists (#29 peds):	1-21	5	
PICU incl cardio (#30):	3-20	6	
Neurosurgeons pedi (#27)	0-27??	2	

Neurologists assigned to ICU: single center

NACHRI

	Total	Median	Average
ICU beds incl CICU (#117)	4-55	16	18

Impediments to recreating

Numbers

Admissions, diagnoses

Assume CNMC 60% > mean

Then mean #of consults for ave program 150/yr ($.4 \times 373$)

Neurology involvement

How to make salary

vEEG now standard

24/7 surveillance??

Billing to neurophysiology service

Therefore need outpatient activity

How to round with PICU? Neurosurgery

Availability during clinic, off hours

PICU most exciting, other boring

Who is willing to give up time in PICU

How to provide added value

Multiple boards (dual residency)

Pediatrics ACGME \geq 2 years

Neurology ABPN 3 years

Pediatric critical care

Adult neurocritical care UCNS \geq 2 years

???CROSS TRAINING

PICU learning on job

Nursing staff !!!!!!!!!!!!!!!

Staff experience

The large Children's Hospitals have an obligation

Physician and scientist training

Multi-disciplinary interventions

Outcomes

University and large community hospitals

PICU programs with identifiable leaders

PICU, neurologist consultant for colleagues, nsgy

Joint protocols, conferences

Intensive research investigation, limited numbers

Scientist training